Personalized Recommendation System for Digital Content

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Abstract

Personalization is an essential element of any content access. Currently, there are only a few platforms that offer personalized digital content services. The platform offers personalized recommendations over Podcasts and Standup Comedy based on user genre preferences. The metadata available in the video descriptions is utilized to enhance search results and proficiency in the topic area. This will provide a personalized environment in which to explore the various genres available. The recommendation will be made using content-driven algorithms. The initial recommendations are based on popularity and then personalized recommendations are made based on acquired data. The final website includes a friendly platform that offers personalized recommendations. Monitoring of user satisfaction and engagement will be monitored and provided with additional content.

Keywords: Digital content recommender system, Content-based filtering, Metadata, keyword embedding, Keyword concatenation, Personalized recommendations, User preferences.

1 Introduction

Digital content is being a very famous way of consuming knowledge, inquire and learn many new technologies and future updates for people in this era of developing technology. Personalizing content which is being consumed by many people would be a great way of helping users with ease in content access and a great way of increase in learning interest or trying to acquire some knowledge based on the topics they want. Even the main platform has become more cluttered with other recommendations which leads users with distraction over the content they are looking for.

This project focuses on a platform that offers content recommendations for booming digital contents such as Podcasts, Stand-up Comedy. This platform allows users with finding a creator whom they have seen somewhere but unable to get their details.

The project importance's the data from video descriptions to provide search results and experience better recommendations. This allows users to explore and experience various genres. The recommendation system algorithm will initially recommend the content based on the popularity, then the rest content.

Colleges and universities can collaborate with us in order to promote their content through this platform and let their students get to know about the developments that are taking place in the other space of their world, which would give a clear-cut idea about needs of future developments in all fields such as technology, construction, etc.

The ultimate goal is to provide an engaging and dynamic platform or website that not only enhances the experience of personalized recommendation of content but also for navigating and accessing options in a user-friendly way.

2 Literature Survey

2.1 Content Based Filtering

Content based algorithm is a machine learning algorithm which is one of the techniques used to build a recommendation system, it basically takes users preferences[1] as an input for recommending them with content. It can even be expanded to recommend content to users based on their watch history too. It mainly advantages the users who interests in watching a particular genre of content rather than exploring multiple new content. Analyses the attributes of the items and match them with users' preferences. CBF allows the content to have a well-defined semantic, which enables the user to better interaction with the supplied information based on their preferences.

2.2 Keywords

Loh has researched and explored about the use of keywords and classes to create user profiles for content-based recommendations. Keywords are automatically extracted from the text [2]. Researchers have developed a system that learns user profiles implicitly by using keywords and their automatically generated relationships [3], these allow relationships enhance the accuracy of similarity calculations. Their system estimates the likelihood of a user being interested a particular item based on the characteristics of the item.[4] tags given as input are improved for precision of recommendations. Tags helped to create more detailed and accurate user profiles.

2.3 Similarity

Content based recommendation involves recommending items that are similar to those a user has previously liked.[5] The core task of content-based recommender system is to calculate the similarity between items. One of the most popular methods for modelling items id the Vector Space Model. This model extracts [6] keywords from an item and assigns weights to them.[18] The prediction of unknown ratings occurs during the active user visit stage. For new users, the user-based predictor is estimated to the ratings. However, for existing users, the item-based predictor is utilized, this significantly enhances the recommendations quality, regardless the users' status which can be new or existing.

2.4 Cold start

Content based recommendation algorithms have an advantage when it comes to providing recommendations to a new users', over the other approaches like collaborative filtering. Collaborative filtering struggles in recommending content to user as there is very limited or no interaction history.[7] Even though a user is new into the system, content-based algorithms can make recommendations based on users' preferences. This is because content-based algorithms analyze the content of the items and make recommendations based on their similarity to items that user has previously liked.[10]

2.5 Information Filtering

Information filtering techniques are essential for removing irrelevant information and content from a user's perspective. Content-based filtering techniques analyze the features of items to make recommendations based on a user's interests.[8] Folksonomy is a user-generated taxonomy that categorizes user interests with tags.

Researchers have developed a method for learning user profiles from both static content and UGC [9]. This method uses semantic analysis of the content and knowledge bases to overcome the limitations of keyword-based approaches. The advantage of this system is that it can analyze both static and UGC, and it addresses the limitations of keyword- based approaches.[11] Main goal of classification learners is to learn a function that predicts which class a document belongs to. In information retrieval system the first step is to identify keywords for representing the documents,[13] It avoids indexing useless words, a text retrieval system often associates stop list with a set of documents. The irrelevant words are called stop list. The information retrieval system needs to identify groups of words where in a group are small syntactic variants of one another and collect only the common word stem per group. A group of different words may share the same word stem.

2.6 Recommendations

This can be divided into two distinct parts: rating prediction and item selection, we focus specially on the rating prediction aspect. The system first determines whether a user is a new user or not. Subsequently, the user-based prediction is performed to calculate the unknown ratings for these new users.[19]
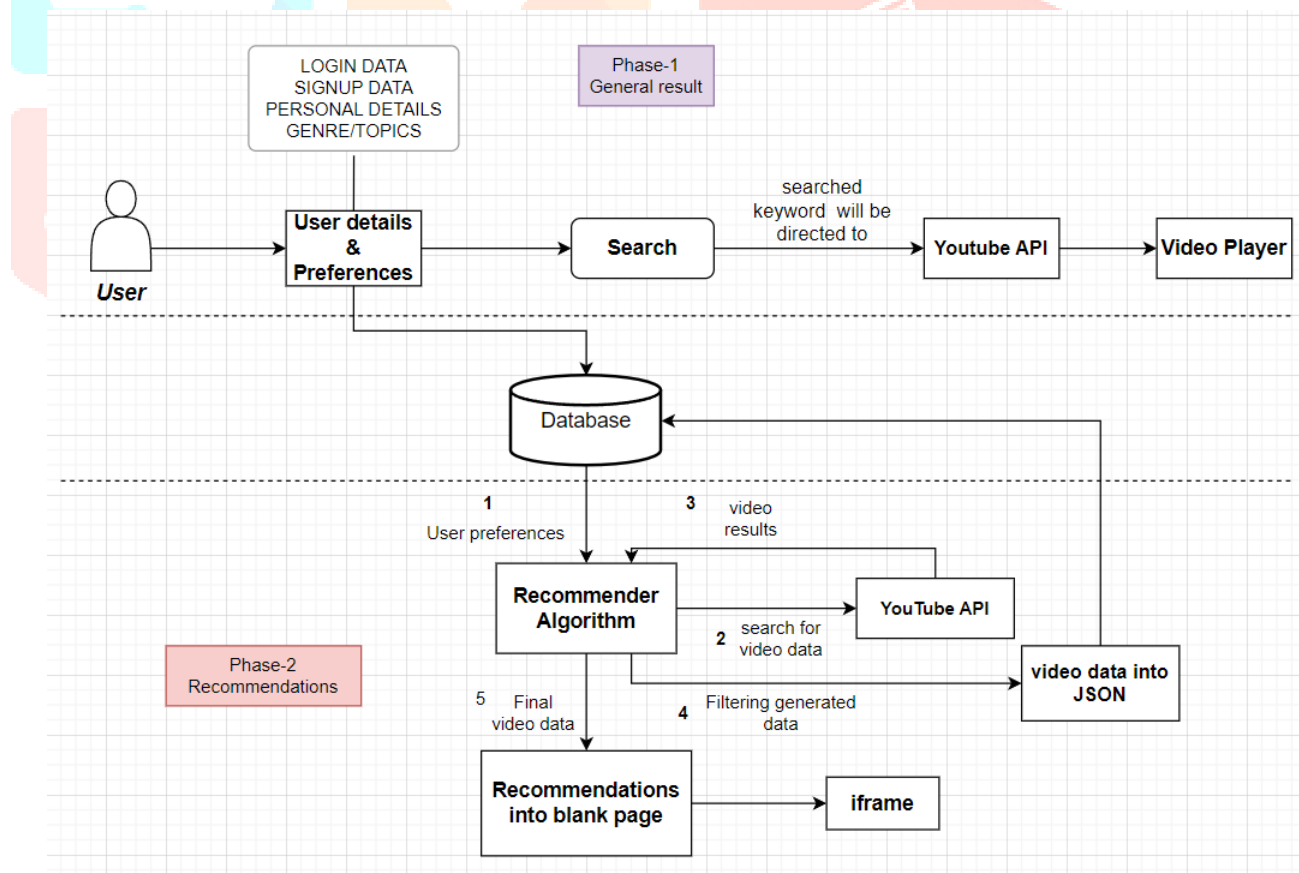
3 System Architecture

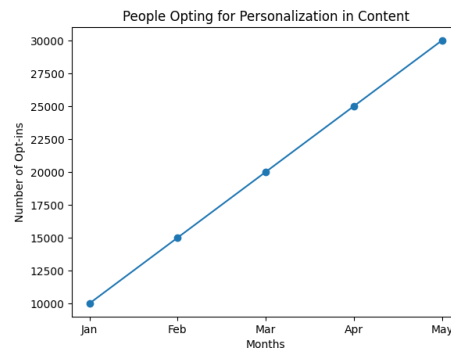Figure 1: System architecture diagram

4 Related Work

Figure 2: Graphical representation of increase in consumption of personalized content.

4.1 Rating Similarity

M(k, d, v) = {v $if k \in d$

$0 otherwise$ 0

Where: M(k, d, v) represents the function that performs a key match and conditional assignment. k represents the key to search for. d represents the dictionary . v represents the default value to assign if the key doesn't exist.

4.1.1 KEY EXISTENCE CHECK

KeyExists(key, dictionary) = { *True if key $\in$ dictionary False otherwise*

GenreValue(key, dictionary) = dictionary[key] if KeyExists(key, dictionary)
else None

Key Exists (KeyExists('name', newdict) = True)
Key Doesn't Exist (KeyExists('name', newdict) = False)

The above equations used for finding out the similarity between the genres selected by the user as their preferences for content recommendation and the genre of a particular video that it comes under. This makes the work easier in assigning videos for a particular user into their recommendation section.

4.2 Information Filtering

```
                                        Video_ID  \
31                                    fYNth2W43vQ
17                                    bZdpihF44R0
23                                    UMUbAvDYh9k
1                                     AhacYw9dkyE
35                                    H1TmEBjZuPQ
41                                    bIKImIqAFoQ
46                                    ORYFMBpWT5w
28                                    7h3YQ5BJTww
20                                    2-7yOF2K9nc
32                                    A7fDNOFTGSo
44                                    TTYZydn0mhU
16                                    -TY_bUDyfZc
9                                     hMGcLWbaurI
34                                    5jh2tur1DSw
21                                    exg7W2Stj54
29                                    3eGP6im8AZA
7                                     a2aoVJoUB80
27                                    uq3SUrhX2bk
2                                     5ZLuuYJM6yw
39                                    M8mDRx0eVPY
37                                    Gjm0ZwLS2sE
42                                            NaN
0                                     8F8sp-umS20
6                                     oON1LuBu9yU
40                                    Zcn6dpZHu84
5                                     wuJAYqBlpnw
30                                    WHLBknRKgYo
10                                    tdD1AlDM7s8
43                                    51NIQ0xx4aA
```

Figure 3: gathering video id's in a random order

```
                            Description      Uploaded Date  \
31  the Vecna transformation is 🧟 #shorts #strange...  2022-06-19T14:00:00Z
17  🔥Tripping Over Nothing Prank 🤣 #comedy #funny ...  2023-06-18T15:56:44Z
23  Ghost Story | Standup Comedy | Munawar Faruqui...  2021-02-28T17:30:13Z
1   Kaala Jaadu | Standup Comedy | Munawar Faruqui...  2022-07-22T11:30:13Z
35  Rani Mukerji speaking in Bangla is too cute🤩✨ ...  2021-05-27T22:29:38Z
41                        It's a caww 🐦 #shorts        2023-04-19T11:00:24Z
46            When A Tantric Meets An Aghori Baba...  2023-02-23T05:00:08Z
28  Aghori Baba Shorts : Power of Aghori #shorts #...  2023-08-27T14:30:05Z
20  Sabse Darwana Experience 😨 - @SushantDivgikarR...  2022-10-20T15:14:26Z
32  REAL BEAUTY OF SANATAN DHARM👀👀🚩🚩🙏 #sanatan #h...  2023-05-06T13:45:44Z
44  Arrogant Boy Has a Secret Allowing Him To Trea...  2022-11-30T17:00:24Z
16            Backwards prank at the hospital #Shorts  2022-10-03T12:00:56Z
9                  Black Magic in Varanasi #BBShorts  2022-12-23T16:09:39Z
34            Why Girls are Touching Samay Raina ? 😂  2023-03-14T05:40:41Z
21  Why You See Nimmbu Mirchi On Indian Roads - Bl...  2023-01-01T15:30:05Z
29             The Black Phone 📞- Official Trailer  2021-10-13T15:00:13Z
7   Ghosts and Periods | Stand Up Comedy by Urooj ...  2022-12-08T06:31:35Z
27  South Indian vs Hindi | Indian Stand Up Comedy...  2019-09-17T08:58:56Z
2   This Real Story Of Black Magic Will Shock You ...  2023-11-08T10:47:58Z
39  Aghori Babas, Shiva Bhakti, Yoga Aur Sadhnas 💀...  2021-10-09T15:33:01Z
37  Janhvi Kapoor &amp; Rihanna's FUN dance on 'Zi...  2024-03-02T07:16:16Z
42                        Mythology &amp; Religion  2023-09-23T12:06:59Z
0   RealTalk Ep.24 Ft. @ijayalani on Ghosts, Black...  2022-12-18T06:40:45Z
6   Kaali Mata ki Kahaani - Black Magic &amp; Agho...  2022-05-26T15:54:07Z
40           Sadhguru Handles a Cobra | Shorts  2021-02-07T12:19:27Z
5   Black Magic Removal,Exorcism and Types Of Spir...  2023-12-03T06:39:00Z
30  A fake Guru cannot know God. He can only cheat...  2023-01-15T11:42:28Z
10  Aghori Culture, Kaal Bhairav, Black Magic, Bal...  2023-09-20T13:33:09Z
43       Bruce Almighty: Bruce controls Evan HD CLIP  2021-01-09T03:00:01Z
```

Figure 4: Collecting video descriptions and date of publish

```
                              Image Link          Views        Likes
31  https://i.ytimg.com/vi/fYNth2W43vQ/default.jpg  208846548.0  6364125.0
17  https://i.ytimg.com/vi/bZdpihF44R0/default.jpg   69059611.0  1480998.0
23  https://i.ytimg.com/vi/UMUbAvDYh9k/default.jpg   26984033.0  1269468.0
1   https://i.ytimg.com/vi/AhacYw9dkyE/default.jpg   15136824.0   890089.0
35  https://i.ytimg.com/vi/H1TmEBjZuPQ/default.jpg   24881508.0   806164.0
41  https://i.ytimg.com/vi/bIKImIqAFoQ/default.jpg   15230746.0   637199.0
46  https://i.ytimg.com/vi/ORYFMBpWT5w/default.jpg   12645822.0   528233.0
28  https://i.ytimg.com/vi/7h3YQ5BJTww/default.jpg   10093746.0   520642.0
20  https://i.ytimg.com/vi/2-7yOF2K9nc/default.jpg    8658237.0   472769.0
32  https://i.ytimg.com/vi/A7fDNOFTGSo/default.jpg    6522649.0   438577.0
44  https://i.ytimg.com/vi/TTYZydn0mhU/default.jpg   18418219.0   423392.0
16  https://i.ytimg.com/vi/-TY_bUDyfZc/default.jpg   51759506.0   420432.0
9   https://i.ytimg.com/vi/hMGcLWbaurI/default.jpg    5894036.0   320165.0
34  https://i.ytimg.com/vi/5jh2tur1DSw/default.jpg    9167665.0   306815.0
21  https://i.ytimg.com/vi/exg7W2Stj54/default.jpg    4803535.0   272950.0
29  https://i.ytimg.com/vi/3eGP6im8AZA/default.jpg   37430232.0   266945.0
7   https://i.ytimg.com/vi/a2aoVJoUB80/default.jpg    4850335.0   217635.0
27  https://i.ytimg.com/vi/uq3SUrhX2bk/default.jpg    8815866.0   212659.0
2   https://i.ytimg.com/vi/5ZLuuYJM6yw/default.jpg    4612813.0   149338.0
39  https://i.ytimg.com/vi/M8mDRx0eVPY/default.jpg    4227815.0   147628.0
37  https://i.ytimg.com/vi/Gjm0ZwLS2sE/default.jpg    4729693.0   139082.0
42  https://i.ytimg.com/vi/Bynh5mkDYn0/default.jpg    8297533.0   128740.0
0   https://i.ytimg.com/vi/8F8sp-umS20/default.jpg    3158086.0   120648.0
6   https://i.ytimg.com/vi/oON1LuBu9yU/default.jpg    3158234.0   110975.0
40  https://i.ytimg.com/vi/Zcn6dpZHu84/default.jpg    3830109.0   102959.0
5   https://i.ytimg.com/vi/wuJAYqBlpnw/default.jpg    2780602.0    93154.0
30  https://i.ytimg.com/vi/WHLBknRKgYo/default.jpg    3654943.0    82751.0
10  https://i.ytimg.com/vi/tdD1AlDM7s8/default.jpg    1858201.0    59743.0
43  https://i.ytimg.com/vi/51NIQ0xx4aA/default.jpg    3455445.0    48219.0
45  https://i.ytimg.com/vi/IIyyEZ6xiD4/default.jpg    1860939.0    47465.0
```

Figure 5: Listing out video images for thumbnails with like and dislike count.
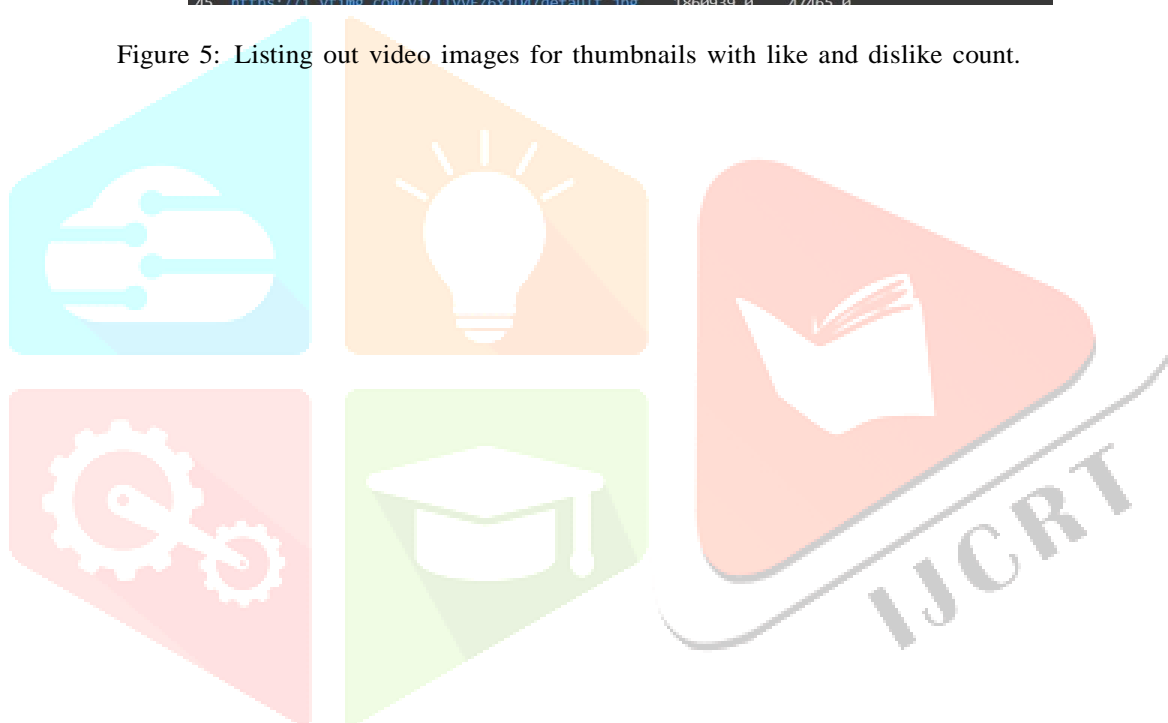
4.3 Keywords gathering

```
Requirement already satisfied: pymongo in /usr/local/lib/python3.10/dist-packages (4.6.3)
Requirement already satisfied: dnspython<3.0.0,>=1.16.0 in /usr/local/lib/python3.10/dist-packages (from pymongo) (2.6.1)
[{'username': 'Uday Chand'}, {'username': 'Nishanth'}, {'username': 'Anand'}, {'username': 'Goutham'}, {'username': None}
```

Figure 6: Storing usernames from database into a dictionary.

```
Requirement already satisfied: pymongo in /usr/local/lib/python3.10/dist-packages (4.6.2)
Requirement already satisfied: dnspython<3.0.0,>=1.16.0 in /usr/local/lib/python3.10/dist-packages (from pymongo) (2.6.1)
[{'username': 'goutham', 'genre': ['Entertainment', 'Sci-fi', 'Music', 'Technology', 'Education', 'Drama', 'Cooking']}, {'username': 'karthik', 'genre': ['Cinema', 'Entertainment', 'Sc
```

Figure 7: Storing username and their preferences.

5 Experiments

```python
def search_youtube_videos(query, api_key):
    base_url =
    params = {
        "part": "snippet",
        "maxResults": 5,
        "q": query,
        "type": "video",
        "key": api_key
    }
    response = requests.get(base_url, params=params)
    return response.json()



videos_dict = {}
genre_preferences = ["happy", "sad", "comedy"]
```

Figure 8: Limiting count of results for each genre to 5.

```
                                    Video_ID  \
▶  7                               8bPWXYM2ysU
   11                              Cl618XVFKmc
⊡  0                               aTUiGWJinX0
   8                               L9pA6sZZjeY
   14                              0HWnjM14csE
   5                               ZJdLJf4ZW-M
   6                               OWkzHkjjXDA
   12                              Xw5iAWCKopo
   2                               j7aRh4utwsQ
   4                               7T1vN2o5Iz0
   13                              OrQNEpH8_60
   1                               wppJ9icLFEo
   3                               NFiNbe7dRYI
   10                              Dwp85SvFLDQ
   9                               ErZksiShSJg
   15                                      NaN
   16  Log: Wed Apr 03 2024 12:34:09 GMT+0530 (India ...

                                   Description    Uploaded Date  \
7    Childhood Dreams | Aakash Gupta | Stand-up Com...  2020-12-19T18:12:29Z
11    Love is Love | Stand-up comedy by Swati Sachdeva  2022-06-09T02:00:12Z
0    Dark Skin &amp; Getting Married | Stand Up Com...  2019-02-11T10:17:36Z
8    Dating and Indian Parents | Stand Up Comedy | ...  2021-07-09T08:30:02Z
14   &quot;College Love&quot; - Stand Up Comedy by ...  2023-03-10T15:00:10Z
5           The Boys | Stand up Comedy by Fatima Ayesha  2023-05-01T11:30:07Z
6       Girls Hostel | Stand Up Comedy | Shashi Dhiman  2023-02-10T11:00:10Z
12   Engineering Boys| Filmy Chokri | Ankita Srivas...  2022-10-09T06:40:11Z
2    &quot;I Am Still Single&quot; Stand Up Comedy ...  2023-02-11T05:00:38Z
4    Break up - Stand Up Comedy by Vivek Samtani an...  2023-05-12T12:30:08Z
13   Gurleen Pannu Stand-Up Comedy | Every Drunk Gi...  2022-09-13T15:30:05Z
1    Love and Peace | Full Show| Stand Up Comedy By...  2022-12-27T05:30:17Z
3    Crowd Work &amp; Airbags | Stand Up Comedy By ...  2023-02-24T05:30:06Z
```

Figure 9: Combined results of each genre.

```
✓   ▶  2    &quot;I Am Still Single&quot; Stand Up Comedy ...  2023-02-11T05:00:38Z
1s     4    Break up - Stand Up Comedy by Vivek Samtani an...  2023-05-12T12:30:08Z
       13   Gurleen Pannu Stand-Up Comedy | Every Drunk Gi...  2022-09-13T15:30:05Z
⊡      1    Love and Peace | Full Show| Stand Up Comedy By...  2022-12-27T05:30:17Z
       3    Crowd Work &amp; Airbags | Stand Up Comedy By ...  2023-02-24T05:30:06Z
       10   Kids in the audience | Stand Up Comedy By Raja...  2023-06-29T05:30:07Z
       9    Friends | Full Show | Stand Up Comedy By Rajas...  2023-12-29T05:30:04Z
       15                                              NaN               NaN
       16                                              NaN               NaN

                                          Image Link        Views       Likes
7    https://i.ytimg.com/vi/8bPWXYM2ysU/default.jpg   36046590.0   1480911.0
11   https://i.ytimg.com/vi/Cl618XVFKmc/default.jpg   21103320.0    962953.0
0    https://i.ytimg.com/vi/aTUiGWJinX0/default.jpg   20630583.0    773439.0
8    https://i.ytimg.com/vi/L9pA6sZZjeY/default.jpg    4341738.0    206219.0
14   https://i.ytimg.com/vi/0HWnjM14csE/default.jpg    2945427.0    131425.0
5    https://i.ytimg.com/vi/ZJdLJf4ZW-M/default.jpg    4103609.0     99205.0
6    https://i.ytimg.com/vi/OWkzHkjjXDA/default.jpg    3525978.0     97940.0
12   https://i.ytimg.com/vi/Xw5iAWCKopo/default.jpg    3194422.0     85664.0
2    https://i.ytimg.com/vi/j7aRh4utwsQ/default.jpg    1689971.0     66112.0
4    https://i.ytimg.com/vi/7T1vN2o5Iz0/default.jpg    1123255.0     49856.0
13   https://i.ytimg.com/vi/OrQNEpH8_60/default.jpg    2137836.0     47399.0
1    https://i.ytimg.com/vi/wppJ9icLFEo/default.jpg    1516666.0     39682.0
3    https://i.ytimg.com/vi/NFiNbe7dRYI/default.jpg    1979660.0     34805.0
10   https://i.ytimg.com/vi/Dwp85SvFLDQ/default.jpg     753381.0     18406.0
9    https://i.ytimg.com/vi/ErZksiShSJg/default.jpg     399554.0     12234.0
```

Figure 10: Thumbnails and likes, dislikes of results.

6 Discovery and Discussions

The project is capable of making recommendations to users based on the preferences that a user has selected while registering themselves into website. A user can view or explore other genres too through search bar or through the keywords in Main page. University Special is independent to users (based on the university tie-ups, the cards will change). We even try to push some other genre of content so that it could be knowledgeable to users regarding the existence of such type of content. Users can easily identify a content creator through profile cards, easily watch all of their content without any limitations

via search bar and access their public profiles sites. A user is allowed to change their preferences after every month. The recommendations that are made to user will change after the update of dataset. The Content Based algorithm keeps on updating the dataset with newer and recent content posted by different content creators in YouTube and even for university students if their respective university updates any videos in YouTube. Content updating will be done in overall dataset and individually for users too.

7 Conclusion and Future work

7.1 Conclusion

The digital content recommendation system will allow users to access their required content by using ML based algorithms and techniques. This platform observes users' personalisa- tion's and interests towards the topics they are searching for and the type of content they are accessing to learn and experience. User experience will be enhanced through responsive navigation between webpages. The application represents a combination of technology and interest in learning new things that would help in development of user's knowledge. Content which are license free will be recommend continuously and licensed content will be shown to users after we seek permissions from content creators.

7.2 Future Work

Extension of content types- The platform could include more types of content such as teach- ing users how to play an instrument and how to create content, etc. Advanced Algorithms- tentative algorithms will not be used. Some new algorithms will be used so that the platform could incorporate more advanced recommendation algorithms, which would potentially im- prove the accuracy of the recommendations. Partnership with creators- The platform could form partnerships with content creators to offer exclusive content, further enhancing its appeal to users. Global Expansion- If the platform is currently available in limited regions, there could be plans for expanding its services globally, reaching out to a broader audience. Chatbot- takes users feedback for improvements and also provides additional and instant recommendations in a limited number.

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